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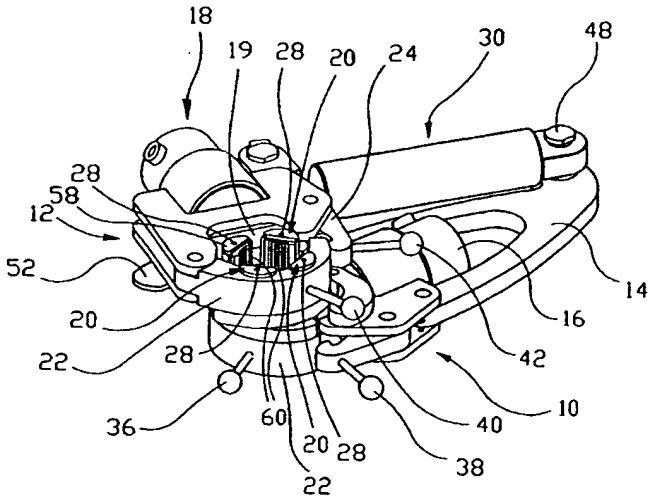
(54) Title: TONG DEVICE, PARTICULARLY A HEAVY DUTY TORQUE TONG



(57) Abstract: Heavy duty torque tongs for clamping pipes/pipe-shaped tools and applying a torque to same in, for example, operations of screwing together. The aim has been to obtain an increased contact surface between the gripping blocks (20) of the tongs (10, 12) and the pipe/tubular tool which is to be clamped and subjected to a torque, which results in less surface damages on the pipe/tool and less deformations. Gripping blocks (20), with the axis of rotation (28) of the individual block (20) located centrally, are arranged in two groups, which may each comprise four blocks (20). Two blocks of either group are arranged in a tong jaw (22), so that in the closed position (operational position) of the tongs (10, 12), they adopt one and the same position from case to case, whereas the remaining two jaws (22) of the group have a piston type cylinder (16, 18) arranged thereto, for movement towards and away from the fixed blocks (20). Each block (20) can pivot relatively freely sideways, back and forth, about the pivot axle (28), and the active serrated attacking surface (60) of each block (20) is curved, outwards concave, in a transversal plane.

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TONG DEVICE, PARTICULARLY A HEAVY DUTY TORQUE TONG

This invention relates to a tong device, in particular heavy duty torque tongs for use in screwing together/unscrewing pipes and tubular tools, for example tools which are to be connected to coiled tubing, two pipes etc., said torque tongs comprising gripping blocks and otherwise being of the kind specified further in the introductory part of Claim 1.

Said pipe and tubular tool normally have different diameters within a range, which is normally to be served by one pair of torque tongs.

Pipes and tools, which are to be screwed together, will for example have diameters in the range of 1-4 inches and be tightened to torques of up to 5000 Nm. This implies that the tongs must provide a very high clamping force in order for the gripping blocks to bite into the pipe/tool, but with clamping forces in this range the result may be that pipes/tools may suffer considerably surface damage besides damage to threads and possibly permanent deformation, squeezing.

Ordinary tongs currently used, are based on fixed gripping blocks. Best known are manually manoeuvrable pipe tongs of the kind that can be bought at the hardware dealer's. The teeth of such fixed gripping blocks are usually placed in a straight line, so that the tongs can be used on pipes/tools of several different diameters. However, the drawback of these tongs lies in the fact that two great spot loads are applied to the pipe on either side thereof.

Other torque tongs, generally in the form of special tongs, often have blocks following a curved extent, each set of gripping blocks being adapted to just one pipe diameter. In such cases the gripping blocks must be changed in the event of a change from one pipe diameter to another. However, the pipe diameters can vary rather often, so that the changing of blocks becomes a time-consuming operation. If the curved gripping blocks of torque tongs are not changed whenever there is a change to suspending and applying a torque to pipes/tools of smaller diameters than those last screwed together/unscrewed, this may result in great spot loads on pipes of small diameters.

Therefore, according to the present invention attempts have been made to avoid, or substantially reduce, these defects and drawbacks of tongs with gripping blocks, and the limitations to use associated with same.

According to the invention, the above-mentioned object has been realized by means of a pair of tongs of the kind specified in the introductory part of Claim 1, which distinguishes itself by exhibiting the features appearing from the characterizing part of Claim 1.

According to the invention, for example two gripping blocks of a set of four gripping blocks in one plane are movable towards and away from the remaining two, for adjustment to the diameter of the pipe or the tubular tool which is to be clamped and rotated, all gripping blocks in this set and possibly other sets positioned at different levels being individually freely rotatable about an axis forming the imaginary main axis of the block, which axis the longitudinal axis of the pipe/pipe-shaped tool should be oriented parallel to, when being clamped in the tongs.

Thereby, the serration of the gripping blocks is such that the series of longitudinal (axial) teeth on each block follows a transversal, outward concave curve, whereby the tops of the teeth point towards the centre of the curve. The curve can be a circular arc or an approximately circular arc or corresponding modified arc. At its rear edge, each of the gripping blocks has a radius, which allows it to be rotated separately about the centre of said radius. The rotatable support of each block can be implemented by means of an axle with a considerable play in the support hole of a tong jaw, support, end cover or similar support/bearing means.

Thereby the centre lines of the blocks will point towards the centre of the pipe/tool. The consequence of this is that the contact surface at the block teeth will be larger than if the blocks were fixed, and increased contact/gripping surface results in less surface damage on pipe/tool and less risk of undesired deformation.

Further advantages, features and details of tongs with gripping blocks formed in accordance with the invention will

be explained in further detail in the following, with reference to the accompanying drawings, in which:

Fig. 1 shows in a perspective view at an angle from above, heavy duty torque tongs with gripping blocks formed and arranged in accordance with the invention, seen in a closed tightening position, pipe, tool etc. having been omitted for reason of exposition;

Fig. 2 shows, in a corresponding perspective view, the same tongs in an open state, ready to be applied round a threaded tubular tool/pipe, which is to be connected to a pipe, for example to the end of coiled tubing;

Fig. 3 shows the same tongs in perspective, seen at a different angle, and with the tongs in a closed state;

Fig. 4 shows the same tongs, seen in a top view, in which the teeth of its two sets of gripping blocks bite into the surface layer of a pipe/tubular tool held firmly in the tongs;

Fig. 5 corresponds to Fig. 4, but here the pipe/tubular tool held, has a smaller diameter, and the covers for the gripping blocks have been removed for reason of exposition; and

Fig. 6 shows, in a top plan view, a lower part of the tongs including a protruding support plate, on which the upper tong part (not shown here) may rest, intermediate plastic pieces (not shown) ensuring the parallelism of the upper and lower tong parts.

The heavy duty torque tongs shown in the drawings comprise two essentially parallel clamping devices 10 and 12 arranged coaxially, shown in a top plan view in Figs. 5 and 6.

The two clamping devices 10 and 12 are functionally similar insofar as the main purpose of the tongs is concerned, but the lower clamping device 10 comprises a lying bow-shaped frame 14.

Each clamping device or tong part 10 and 12 comprises an actuator, which can be extended/shortened, here shown in the form of a hydraulic piston type cylinder 16 and 18, respectively, arranged for linear displacement of a slide 19, in which there are supported two gripping blocks 20, which form one half of the gripping blocks 20 of each set of gripping blocks on each level or "floor". The two remaining gripping blocks 20 of each set are supported on pivotal tong jaws 22 which can be locked and released by means of catch levers 24.

As appears for example from Fig. 4, the gripping blocks 20 on one level may be offset (about a vertical axis 26) relative to the gripping blocks 20 on the second level, so that a largest possible area of the clamped pipe is influenced by the gripping blocks, counted in the circumferential direction.

Each gripping block 20 is supported individually rotatable about an axle or bolt 28, whose axis extends parallel to said vertical axis 26 and to the general longitudinal direction of the gripping blocks 20.

The bow-shaped frame 14 of the lower clamping device/tong part 10 form a jointed connection for a third extendable/ shortenable actuator driven by pressurized fluid, in the form of a piston type cylinder 30 with a considerable stroke. The piston rod end of this piston type cylinder 30 is articulated with a projecting lug 32 on the tong body, and serves to apply a torque to the tongs 10, 12 and the pipe/tool clamped therein, for tightening during an operation of screwing together, or during a reverse operation when two pipes screwed together, a pipe screwed together with a tool, or two tubular tools screwed together, are to be unscrewed from one another.

The pivotal arms 24 with the catch levers are spring-biased 34.

Several of the parts of the tongs, which are moveable and hinged to one another, are provided with a rigidly projecting handle 36, 38, 40, 42 each.

When the tongs are to be used, starting from the exemplary closed position shown in Figs. 1 and 3, they are opened by the use of the handles 36, 38, 40, 42 by pivoting open the two jaws 22 after release of the locking arms 24 with the catch levers.

The tongs in their open position are shown in Fig. 2. In this open tong position, each of the two piston type cylinders 16 and 18, arranged to a slide 19 for two gripping blocks, are in a contracted position, which allows insertion of a pipe 44 of a given diameter; the pipe diameter is for example larger at the pipe/the tubular tool shown clamped in the tongs, according to Fig. 4, than that in Fig. 5.

After the pipe/tubular tool 44 has been introduced into the space between four gripping blocks 20 on one level and four gripping blocks 20 on another level (i.e. an upper and a lower level, imagining a vertical axis for the desired operation of screwing together/unscrewing), the jaws 22 are pivoted into their active position and are blocked by the catch lever arms 24, and the piston type cylinders 16 and 18 are extended by the piston and piston rod being pushed out, whereby the gripping blocks 20 of each set pivot about their individual axles 28 for purpose of self-adjustment on abutment against the curved pipe surface/tool surface.

In Fig. 5 the covers externally on the gripping blocks 20 have been removed, so that it appears that the two movable blocks 20 of one set, rest on a complementary bed 46 each, which is welded to the respective slide 19. The slide is somewhat narrower than the height of a gripping block.

The two clamping devices/tong parts 10 and 12 are interconnected by a (vertical) axle 48, which also forms a joint for the closed end of the piston type cylinder 30 and a chain link 50.

The upper tong part/clamping device rests on a segment-shaped support plate portion 52, Figs. 5 and 6, incorporated as a rigid component in the lower tong part/clamping device 10.

For the two tong parts 10 and 12 to be oriented parallel to each other, intermediate spacer discs 54, 56 are provided, for example formed in a suitable plastic material, Fig. 2.

Each set of gripping blocks comprises four blocks with an axle 28 each, for independent individual rotation in use

about an axis (the axis of the axle 28) parallel to the axis 26 of the pipe 44, the tubular tool or other pipe element 44, which is to be clamped in the tongs 10,12 and screwed to/unscrewed from another pipe etc.

Each gripping block 20 is arranged about its respective axle 28 with free pivotability and little friction, so that individually and independently of one another they pivot sideways when adjusting to the adjacent curved portion of the pipe/the tubular tool, which is to be clamped, among other things, in the tongs 10,12 between the in total eight gripping blocks thereof, which are arranged in two sets of gripping blocks, displaced parallel to each other, see for example Fig. 2.

The constructional configuration of each gripping blocks 20 can comprise end covers 58 and possibly a rear end cover 58' forming beds for the gripping blocks 20. One pair of end covers 58 may serve for the convenient support of the associated axle 28. Thus, the forces which arise during the screwing together, are not absorbed by the axles 28, but of the beds of the gripping blocks 20 with associated structure.

The active bearing and compressive surface of the gripping block 20, facing the imaginary axis 26, Fig. 4, of the clamping device of the torque tongs 10, 12, is formed with teeth 60 extending parallel to one another and essentially parallel to their longitudinal direction and the axis of the axle 28, is formed so that transversally to the longitudinal direction (vertically) of the teeth 60 it has a laterally concave curve, so that the row of teeth form an arc, towards whose centre the tops of the teeth are pointing. Each gripping block 20 has a radius at its rear end, which allows

the block body to rotate about the centre of said radius, through which centre the axis of the respective axle 28 extends. The purpose of this is that the centre line of each gripping block will point towards the centre/axis of the pipe/tool. The result of this will be that the contact/abutment/gripping surface opposite the pipe/tool surface will be essentially larger than if the blocks 20 are fixed, and an increased gripping surface unambiguously involves that the pipe/tool clamped in the tongs and subjected to torques from the third hydraulic piston type cylinder, suffers less surface damage and will be subjected to reduced risk of deformation when being screwed together.

C L A I M S

1. A tong device, especially heavy duty torque tongs, preferably for use in screwing together two pipes (44), a pipe and a tubular tool or two such tools, or in unscrewing two pipes etc., which have been screwed together, and comprising a number of gripping blocks (20) spaced apart in the direction of the tong axis, each block (20) being provided with an active bearing and compressive surface opposite the pipe (44) or tubular tool which is to be clamped in the tongs (10,12), c h a r a c t e r i z e d i n that for example half the gripping blocks (20) of one set, two first blocks (20), are arranged with essentially stationary axes of rotation (28) in the tongs or in a pivotal tong jaw (22), whereas for example two further blocks, which may form the second half of the gripping blocks (20), two second blocks, have an actuator (16,19; 18,19) arranged thereto and arranged to reciprocatingly move said second blocks (20) relative to said first blocks (20); that the effective bearing/gripping surface (60) of each gripping block (20), which is to bear against and bite into and grip round the adjacent curved surface of the pipe/tool (44), preferably has an outward concave curved extent in the transversal direction.

2. A tong device according to claim 1, c h a r a c - t e r i z e d i n that the active gripping surface of each block (20) is formed with teeth (60), grooves, splines or similar projections, roughly speaking parallel to one another and extending essentially parallel to the axis of rotation of the respective block (20), formed by a through axle (28) mounted in end

covers (58), supports or similar incorporated in the tong construction, ensuring free sideways pivoting of each block body relative to the curved surface of the pipe/tool (44) to be clamped/subjected to a torque.

3. A tong device according to claim 2, c h a r a c - t e r i z e d i n that the concave curve of the cross-section of the respective gripping block (20), formed by the row of teeth (60), has a centre, towards which the tops of the teeth are pointing.

4. A tong device according to claim 3, c h a r a c - t e r i z e d i n that each gripping block (20) has a radius at its rear end, allowing the block to pivot about a centre of said radius, through which the axis of the axle (28) extends, so that the centre line of each gripping block (20) will point towards the axis (26) of said pipe/tool (44) in the clamping condition.

5. A tong device according to any one of the preceding claims, c h a r a c t e r i z e d i n that said actuator (16,19; 18,19) comprises a piston/telescope type cylinder (16, 18) operated by fluid pressure, which has a slide (19) arranged thereto, exhibiting individual beds (46) for each gripping block (20).

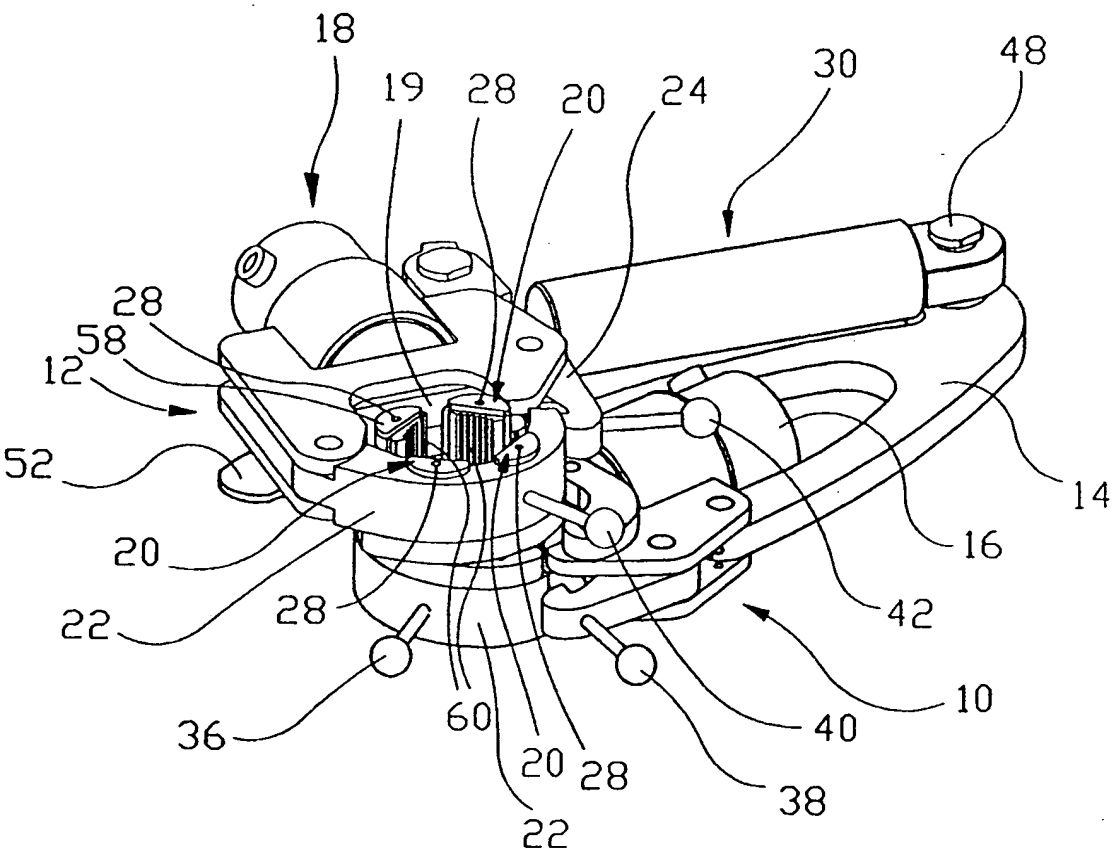
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FIG. 1

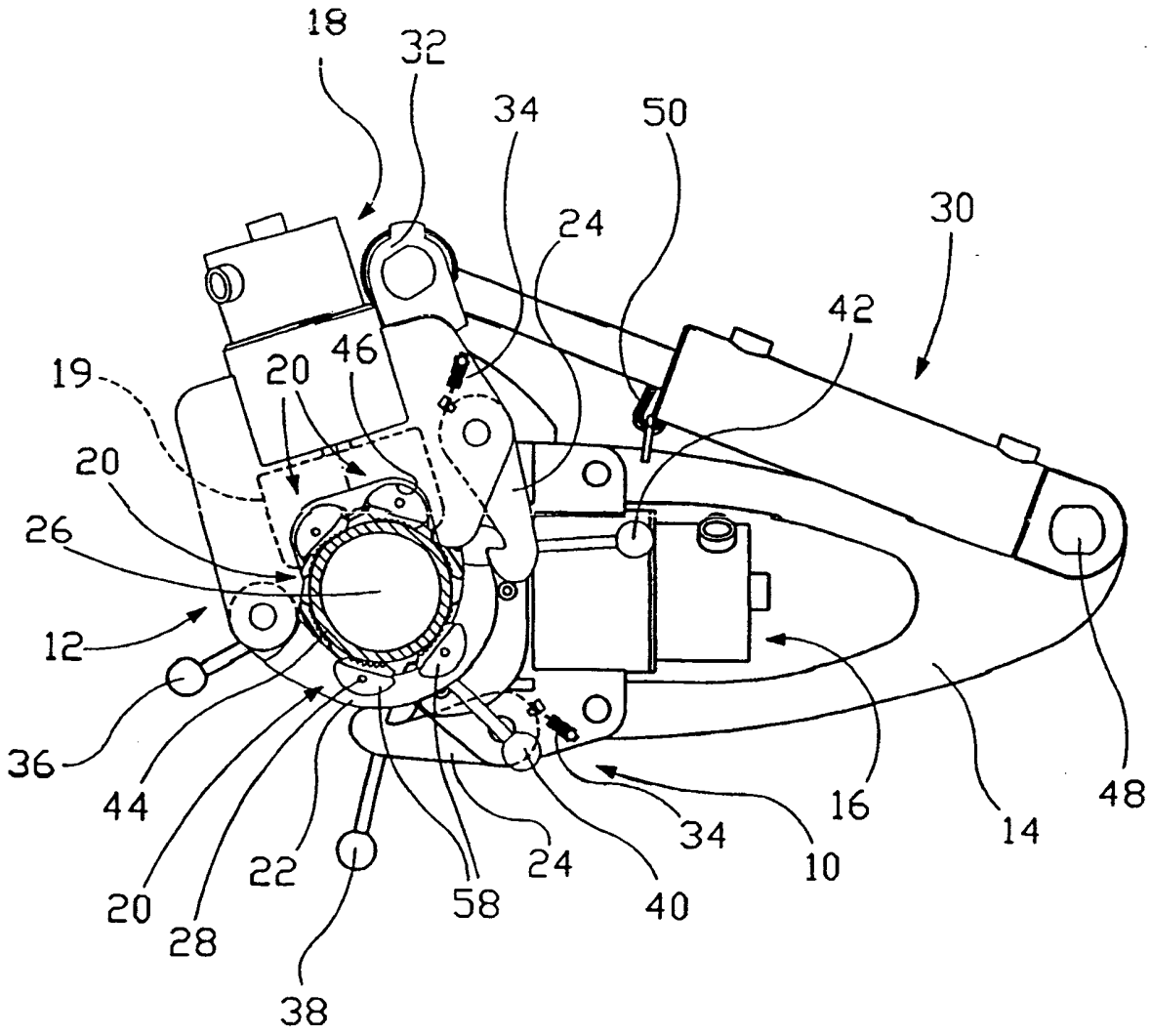
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FIG. 4

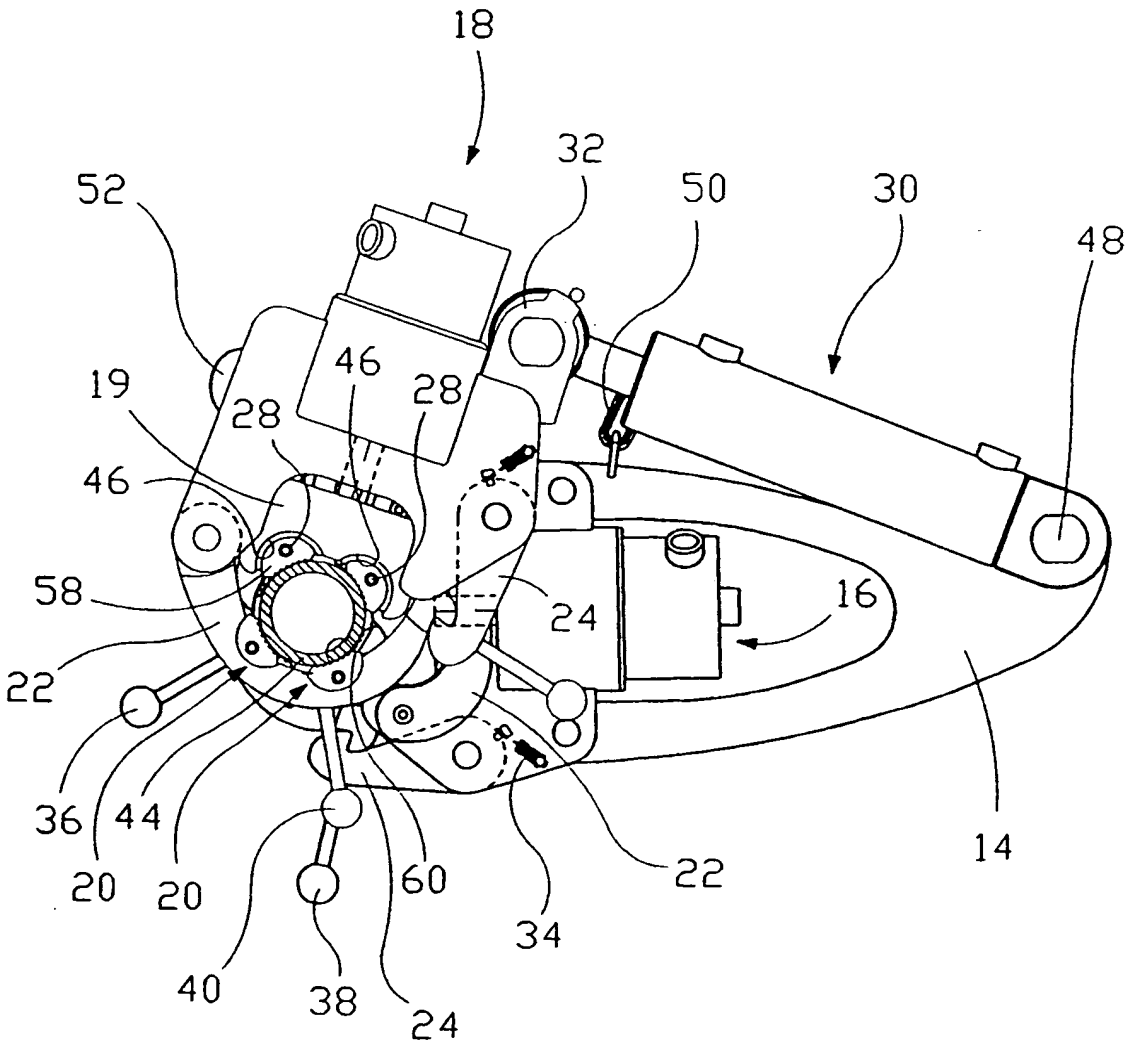
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FIG. 5

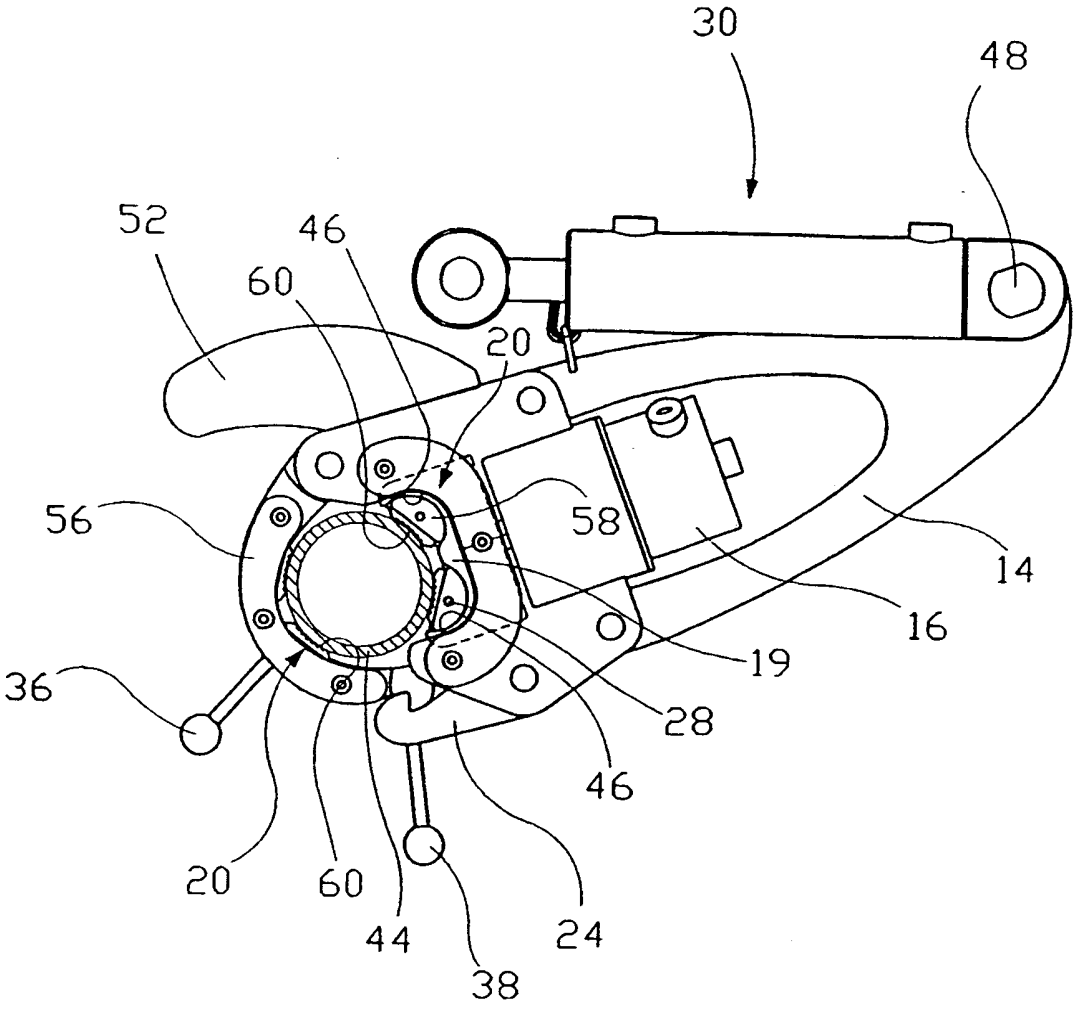

FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NO 00/00180

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B25B 13/50, E21B 19/16
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B25B, E21B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5542318 A (WILLIAM E. WESCH, JR.), 6 August 1996 (06.08.96), column 3, line 42 - line 58; column 4, line 42 - line 50; column 5, line 57 - line 59, column 7, line 23 - line 24; figure 1 --	1-5
A	WO 9713618 A1 (BUCK, DAVID, A.), 17 April 1997 (17.04.97) --	1-5
A	US 5778742 A (RANDOLPH L. STUART), 14 July 1998 (14.07.98) --	1-5

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
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Date of the actual completion of the international search	Date of mailing of the international search report
8 Sept 2000	14 -09- 2000
Name and mailing address of the ISA: Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. + 46 8 666 02 86	Authorized officer Ola Engstrand/MP Telephone No. + 46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NO 00/00180

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5740703 A (ROBERT G. PERRY), 21 April 1998 (21.04.98) --	1-5
A	US 4727781 A (CHEN YUEHUI ET AL), 1 March 1988 (01.03.88) --	1-5

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/NO 00/00180

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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US 4727781 A	01/03/88	NONE	

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